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ABSTRACT

This is the second edition of a curriculum guide for elementary school mathematics. It is one of a series intended to serve as a model for Alaskan school districts as they develop and review their curriculum documents. Listed are topics and concepts, learning outcomes and objectives, and sample learning activities. The learning activities are indicators of student progress toward the learning outcomes, with at least one sample activity to illustrate each outcome. The preface to this guide discusses the importance of mathematics and presents 14 goals. The topics/concepts and objectives/outcomes are numbered consecutively, which facilitates reference to specifics within this guide and cross-reference between guides. The sequence of topics/concepts is indicated by whole numbers for: sets and patterns, counting and numeration, whole number operations, fractions and decimals, fraction operations, measurement and estimation, geometry, math sentences, probability and statistics, problem solving, calculators and computers, integers, and ratio, percent and proportion. The guide is organized for grades 1-3, 4-6, and 7-8. Histograms of the cognitive levels of the learning outcomes are provided, showing the percentages of objectives at each level. (MNS)

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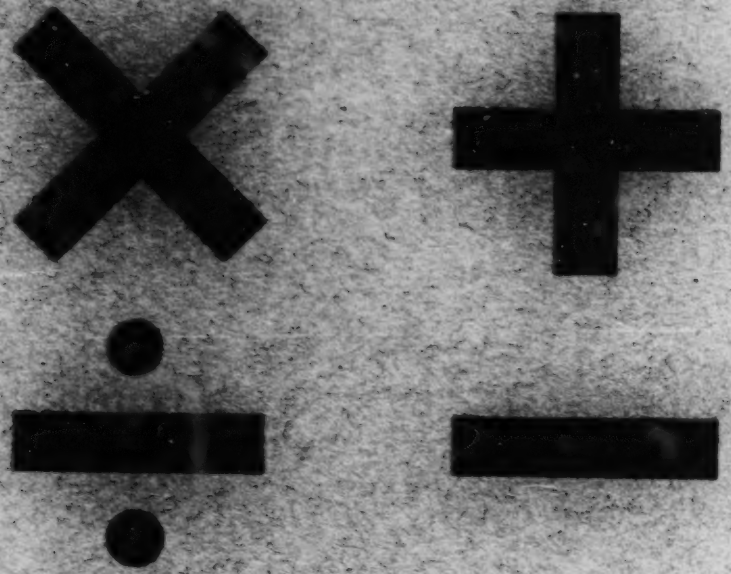

Alaska

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Curriculum Guide

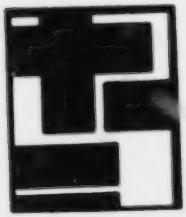
Second Edition

ALASKA

ELEMENTARY MATHEMATICS

MODEL CURRICULUM GUIDE

Second Edition



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ELEMENTARY MATHEMATICS

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"Some measure of genius is the rightful inheritance of every person."

Alfred North Whitehead

ALASKA MODEL CURRICULUM SERIES

GENERAL PREFACE

Among the many decisions that schools must make, none is more important than the choice of curriculum. Curriculum defines the intent behind instruction and the expectations for student performance. This Second Edition curriculum guide is one of a series intended to serve as a model for Alaskan school districts as they develop and review their own curriculum documents. It is not intended that these guides be used directly by teachers for classroom instructional purposes. Districts are expected to develop their own locally suitable curriculum, using these guides as a base and a point of departure. In the future, as districts use the guides to develop and implement curriculum, their value will be measured by the increased ability of Alaskan students to learn, think, and perform as informed and productive citizens.

In their present form these guides represent a synthesis of input from many sources, both Alaskan and national. They were originally prepared by staff at the Department of Education with the help of professional content associations, Alaskan teachers and administrators. An extensive review and revision process of the first drafts was conducted in 1984-85. School districts, subject matter associations, other professional associations, and interested individuals were part of a revision process that was contracted to the Northwest Regional Educational Laboratory. A panel of nationally recognized curriculum specialists assisted in the original review of each content area. (Contributions to specific guides are listed in the acknowledgments sections of the guides.)

In one sense, these guides will never be finished. It is the intention of the Department of Education that they be dynamic documents, subject to revision as part of the six year curriculum review cycle The state's cycle was initiated by the Department after the curriculum regulations of 1984 were adopted.

Guides exist in the areas of:

Kindergarten	Fine Arts
Language Arts	Social Studies
Science	Computer Education
Foreign Languages	Health
Mathematics	Physical Education

The format of the guides is straightforward but not oversimplified. Each guide lists Topics/Concepts, Learning Outcomes/Objectives, and Sample Learning Activities in three columns.

Topics/Concepts, in the first column, describe the major parts of the subject under consideration. They define broadly the content to be included in the study of each subject area.

Learning Outcomes/Objectives, in the second column, describe, in general terms, the behaviors which students are expected to demonstrate as a result of their learning experiences. Learning outcomes/objectives are the goals toward which student learning is directed.

Sample Learning Activities, shown in the third column, are indicators of student progress toward the stated goals, i.e., the learning outcomes. At least one sample learning activity is stated to illustrate each learning outcome. It is intended that the sample learning activities are just that: samples only. They do not constitute a learning program. Alaskan districts will generate their own locally applicable learning activities within the framework of their district's chosen topics/concepts and learning outcomes.

The guides are grouped by grade level groupings -- grades 1-3, 4-6, 7-8 at the elementary level, and 9-12 at the secondary level. Recognizing the unique characteristics of the five year old learner, kindergarten was prepared as a separate guide. In the development, grades 7-8 were generally seen as the end of the elementary years, but with some beginnings for the secondary level. On the secondary level the guides generally contain discrete one or two semester courses that would be offered; these are not always tied to a particular grade level as the local district must determine the most effective sequence for these courses.

In 1984 the Alaska State Board of Education stated, "The Model Curriculum Guides are intended to serve as a model, not a mandate." They underscored the fact that a partnership between

the state and local school districts is crucial. The Board affirmed the need to promote individual variation while stressing the collective responsibility for educating all students in Alaska. It is in this spirit that the Department of Education welcomes the opportunity for continuous collaboration with those interested in the further development and refinement of this entire series of guides.

PREFACE

ELEMENTARY MATHEMATICS MODEL CURRICULUM GUIDE

A cardinal goal of education is to develop informed, thinking citizens who armed with the knowledge, attitudes, motivation, self-confidence, and skills to work individually and collectively, can affect positive change in a complex word. Within this context, a primary goal of mathematics education is to foster students' ability to solve problems. Clear and logical thinking is the basis of good mathematical reasoning and is a skill essential to life and to the study of other disciplines. Mathematical literacy and self confidence is required to function effectively in a society in which mathematics is widely used. Sound mathematics education promotes a feeling of efficacy and confidence in situations where reasoning and qualitative thinking are needed. Understanding mathematics also provides the background necessary for a variety of educational and vocational options. Comprehension of mathematics further permits an opportunity to enjoy the intrinsic beauty of mathematical processes.

The major goal of the Alaska Mathematics Curriculum Guide for elementary mathematics in grades 1-8 is to provide a set of related and specific goals, instructional objectives and choice of essential subject matter.

The Learning Objectives/Outcomes of the Alaska Elementary Mathematics Curriculum Guide have been developed to help young people meet the following specific goals:

1. Use the language and symbolism of sets, set operations and their properties.
2. Use the principles of inductive and deductive logic.
3. Measure things using specific units of measure.
4. Use the symbols, elements, operations and functions of whole numbers, integers, rational numbers, real numbers and when appropriate, complex numbers and finite and infinite systems.
5. Solve open sentences.
6. Solve problems using graphs, tables and mathematical statements.
7. Use problem identification, analysis, organization, evaluation, application and generalization to solve real and everyday problems.
8. Value the development of mathematical skills and knowledge.
9. Solve practical problems using mathematical sentences or models and interpret the solution in the context of the problem.

10. Use geometric definitions, postulates and theorems to solve problems.

11. Compute using numbers and algebraic expressions.

12. Describe the importance of counting, measuring, mathematical symbols and systems to historical and cultural development.

13. Use probability and statistics to solve problems.

14. Use calculators, computers, slide rules and other support technology to solve problems.

The curriculum guide offers examples of how these skills can be demonstrated within the learning environment; it is expected that local districts will consider and adjust the objectives/outcomes and activities in light of their own curricular goals and educational program. The scope and sequence at the end of this preface indicates suggested grade levels at which the concepts/topics can be covered. Many basic learning outcomes/objectives are presented in the primary grades. This initial presentation will not be retained without reinforcement; skills and concepts need to be continually reviewed and extended. The necessity for maintenance and periodic review is sometimes indicated by the repetition of a learning outcome at a later grade. Though the repetition of all learning objectives/outcomes would result in an unnecessarily massive guide, the reinforcement of skills is strongly recommended throughout the elementary grades.

The topics/concepts and objectives/outcomes are numbered consecutively throughout the elementary mathematics guide. This facilitates reference to specifics within this guide and cross reference between guides. The sequence of topic/concepts is indicated by whole numbers, for example 1.0 for Sets and Patterns. Integers and Ratio and Proportion are not introduced until 4-6 grade so are final two topics numerically. The corresponding Learning Objective/Outcomes for each topic/concept are indicated with the same first integer and sequential numbering after the decimal point, through the entire guide from 1-3 to 7-8. For example, objective 2.10 follows 2.9, (is not equivalent to 2.1) and is found in the 3-6 grade section. Some cross referencing between disciplines is indicated in this guide. The future integration of a numbering system in all guides will permit more specific references.

Most learners, young children to adults, benefit from using concrete materials when encountering a new concept. In developing each concept or outcome, it is expected that the chosen activities will progress from the concrete use of hands-on material, through pictorial representation and then to abstract symbolization. Knowledge of the cognitive development of students should be used to determine when a student is ready to move from one level to another. Specific activities or manipulative items should be selected from experiences in a child's daily life. Learning styles should also be taken into consideration in the design of recommended activities. In designing programs, districts should attend to local solutions to the problem of under-representation of females and some minorities in higher-level mathematics courses.

While the issue arises at the high school level and creates barriers to career or college study options, it is a K-12 concern and should be addressed as such.

Though all topic areas in the guide are fundamental to accomplishing the specific goals listed above, our lives and society demand emphasis on some areas over others. Numeration concepts demand priority attention. A premature emphasis on numerical operations often results in difficulties with whole number and rational computation. For example, students often treat fractions as re-arranged whole numbers rather than a different kind of number. Measurement is probably the single most frequent application of mathematics. The need for knowledge of statistics has increased dramatically and can be expected to continue to do so.

Several topics, also treated on their own in this Curriculum Guide, should be infused across the other topics. A priority throughout mathematics education is problem solving. Problem solving includes, but is not limited to, solving story problems. To the degree feasible, all the concepts should be developed in a problem solving mode. The transfer and application of problem solving from the mathematics classroom to real world situations, is necessary for students to deal successfully with their world. Estimation and use of mental arithmetic are a integral to problem solving, and are steps in all computation. Judging reasonableness through the use of estimation is a necessary component in meaningful use of calculators and computers. These tools are employed across topics and grade levels. Students should compute efficiently, employing different and appropriate methods in a

variety of situations. There is an emphasis on the consumer and real world applications of all mathematics, not only in Consumer Math but as a common theme through the other courses as well. Real world applications are strengthened by cross references to other disciplines. These cross references will be elaborated on in the future as other guides go through the revision process and are sequentially numbered.

At the elementary level, the following framework is employed, indicating grade level placement for topics/concepts:

		GRADES							
		1	2	3	4	5	6	7	8
	Topic/Concept								
1.0	Sets and Patterns	X	X	X	X	X			
2.0	Whole Numbers - Counting and Numeration	X	X	X	X	X	X	X	
3.0	Whole Numbers - Operations	X	X	X	X	X	X	X	X
4.0	Fractions and Decimals	X	X	X	X	X	X	X	X
5.0	Fraction Operations				X	X	X		
6.0	Measurement and Estimation	X	X	X	X	X		X	X
7.0	Geometry	X	X	X	X	X	X	X	X
8.0	Math Sentences		X	X	X	X	X	X	X
9.0	Probability and Statistics	X	X	X	X	X	X	X	
10.0	Problem Solving	X	X	X	X	X	X	X	X
11.0	Calculators and Computers	X	X	X	X	X	X	X	X
12.0	Integers						X	X	X
13.0	Ratio, Percent and Proportion						X	X	X

ELEMENTARY MATHEMATICS

GRADES 1 - 3

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
1.0 SETS AND PATTERNS	1.1 Label and classify by set attributes.	Identify a collection of objects as a set, such as marbles in a bowl. Tell which things are members of a set and which things are not, given a set of objects such as stones, block or bones. Classify and sort leaves by observing relationships. Count and name the numbers of a given set.
	1.2 Explain one-to-one correspondence and set equivalency.	Demonstrate one-to-one matching between members of two equivalent sets in more than one way, using familiar objects. Identify two sets as equivalent or nonequivalent; tell which set has more and which set has fewer members; write number sentences to describe the sets. Tell how many more or fewer members are in nonequivalent sets. Put three dolls in one box and ask students to put the same number of trucks in another box.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	1.3 Distinguish empty set, subsets, and set union.	
		Identify a subset of a set such as univalue shells from a set of shells.
		Generate a set which has no members such as a set of polar bears in the classroom.
		Remove a subset from a given set of elements and get a remaining subset such as the litter from everything collected on a field trip.
		Associate a numeral with a set that names the number of elements in the set.
		Identify the union of set of animals of the tundra and animals of the ice pack.
	1.4 Recognize simple patterns.	
		Recognize a pattern; describe and extend it.
		Use pattern blocks to establish a color sequence and ask the child to describe the rule that establishes the pattern and then continues the pattern.
		Complete a pattern of shapes in a drawing.
		Group objects based on common attributes.
		Complete a simple number pattern.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
The Learner will:		
		Clap a rhythmic pattern.
		Continue a pattern of numbers, subtractive or additive, in increments of five or less.
2.0 WHOLE NUMBERS - COUNTING AND NUMERATION		
	2.1 Use order relationships.	
		Identify which group of blocks has more items.
		Identify which group of rocks has less items.
		Write a set of whole numbers in order from least to greatest and from greatest to least.
		Write the symbols, >, < to express the relationship between two given numbers.
	2.2 Demonstrate conservation of number.	
		Rearrange a group of five blocks and identify that the two groups have the same number.
		Show equivalency between groups of the same number of gym balls and marbles or pebbles.
	2.3 Demonstrate an understanding of number, numeral and the spoken word.	
		Identify and read numerals for whole numbers 0-99.
		Read and write number words one through ten.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
The Learner will:		
	2.4 Understand the ordinal numbers first through tenth, first through twentieth and then beyond twentieth.	Identify the position of objects or events using first through tenth positions. Use opportunities when students need to take turns to demonstrate ordinal numbers, such as bathroom lines or kickball. Identify the position of a particular object or event, using more than 20 objects or events.
	2.5 Demonstrate concepts related to counting, recognizing and using numbers 0-99.	Arrange nonequivalent sets in order of cardinal size. Order numbers such as 4 and 9 by saying that a group of 4 objects is less than a group of 9 objects. Identify the numbers which immediately follow and precede a given number, 0-1,000.
	2.6 Distinguish between the concept of odd and even numbers.	Identify and name odd and even numbers. Make groups of odd and even numbers of objects.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	2.7 Know cardinal numbers 0-1000.	Group the members of a given set by ones, twos, fives, and tens by counting how many members are in the set. Identify, name, read and write numerals 0-999. Read and write number words through twenty. Compare two whole numbers, each less than 1,000, by telling which is greater or less than the other. Write whole numbers in order from least to greatest and from greatest to least.
	2.8 Identify place value of up to four digit numerals.	Identify the numerals in the ones place and numerals in the tens place, given a list of two-digit numerals. Write an expanded numeral (23 = (2x10) + (3x1)). Group objects to create an understanding of tens and ones.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Identify and name the numerals in ones, tens, hundreds and thousands places, given a list of four-digit numerals.
		Write the expanded version of a four-digit numeral.
3.0 WHOLE NUMBERS - OPERATIONS	3.1 Demonstrate the addition facts with sums through 18.	
		Use the feltboard to construct sets of shapes or colors.
		Make sets of unifix cubes, sticks, or leaves, and combine subsets to determine sums.
		Demonstrate addition by using a number line.
		Name, using immediate recall, the sum of an addition fact, through sums of 18.
	3.2 Demonstrate column addition with no regrouping.	
		Play "Double War," a card game where the sum of two cards is compared with the sum of the opponents cards.
		Demonstrate sums of two-digit numbers using cuisenaire rods.
		Find the sums for problems with two-digit numerals that do not require regrouping.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	3.3 Employ the commutative property of addition.	
		Use sets of buttons to demonstrate the commutative property of addition.
		Write addition equations to describe the commutative property.
		Solve equations with sums to 10,000 using the commutative property.
	3.4 Employ the associative property of addition.	
		Use sets of numbers or a number line to demonstrate the associative property of addition.
		Write and solve an addition equation using the associative property.
		Indicate the grouping of addends which will make the addition easiest for a given problem.
	3.5 Apply the identity element for addition.	
		Use sets or a number line to demonstrate the identity element for addition.
		Solve equations using the identity element.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	3.6 Understand the concept of subtraction with differences through 10.	
		Make sets of pebbles or shells and remove subsets to determine differences.
		Demonstrate subtraction by using a number line.
		Write two addition and two subtraction facts to describe a set.
		Name differences in problems written in both horizontal and vertical notation.
	3.7 Demonstrate column subtraction with no regrouping.	
		Demonstrate differences with two digit numerals using cuisenaire rods.
		Find the differences for problems with two-digit numerals that do not require regrouping.
	3.8 Know how to add and subtract whole numbers using standard algorithms, with or without regrouping.	
		Write the two related subtraction equations of an addition equation.
		Check subtraction problems using addition.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Name the sums and differences for problems (four-digit numerals) without regrouping.
		Identify and name sums, differences, missing addends and missing operational signs in problems written in both horizontal and vertical notation.
		Use mental arithmetic to compute sums and differences less than 100.
	3.9 Apply regrouping in solving problems.	
		Name the sums and differences for problems with two digits using regrouping.
	3.10 Compute column addition and subtraction of three-digit numerals.	
		Name the sums and differences for problems with three-digit numerals.
	3.11 Estimate solutions to addition and subtraction problems.	
		"Guesstimate" and check solutions using a calculator.
	3.12 Compare multiplication and division of whole numbers and their related properties.	
		Use pictures or objects to show the combination of sets; determine and name the product of the numbers.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Divide a set of objects into equivalent subsets; name how many subsets can be formed.
		Design a simple experiment involving set partition to determine and name the quotient of a division problem.
		Demonstrate inverse relation of multiplication to division.
		Identify and name products and quotients in problems written in both horizontal and vertical notation.
	3.13 Apply the commutative property of multiplication using one-digit numerals.	
		Demonstrate the commutative property of multiplication using sets.
	3.14 Apply the associative property of multiplication.	
		Solve equations using the associative property of multiplication to simplify computations.
	3.15 State algorithms for factors of 10 and multiples of 10.	
		Name the products and quotients for problems using factors or multiples of 10.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	3.16 Apply the identity element for multiplication.	Solve equations using the identity element for multiplication.
	3.17 Apply the multiplication property of zero.	Solve equations using the multiplication property of zero.
	3.18 Apply the distributive property of multiplication over addition.	Demonstrate the distributive property by using sets.
	3.19 Know how to multiply and divide two-digit numbers by one-digit numbers.	Name the products for problems using two-digit and one-digit factors with and without regrouping. Use mental arithmetic to estimate products and quotients with one-digit factors.
	3.20 Estimate the solution of division and mutliplication problems.	Given a list of problems and solutions, students will report on the reasonableness of proposed solutions.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	3.21 Analyze solutions to word problems.	As a group, solve simple one step word problems involving addition and subtraction of one-digit numbers. Solve one-step word problems involving multiplication of a one- or two-digit number by a one-digit number and discuss with class.
	3.22 Choose the appropriate method of calculation.	Given a series of problems, choose between esimation, mental arithmetic, paper and pencil, or calculator to find the solution.
4.0 FRACTIONS AND DECIMALS	4.1 Understand the fractions 1/2, 1/3, and 1/4.	Identify and name the fractions 1/2, 1/3 and 1/4, given models. Construct models for 1/2, 1/3, and 1/4. Use cookery measuring units to explain functions. Cut fruit or snack items up into fractional units.
	4.2 Be able to read and write the fractional numeral.	

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Identify, name, read and write a numeral for the fraction that is represented by a physical model.
		Identify and represent halves, thirds, fourths and tenths by parts of sets and on a number line.
	4.3 Define fractional numbers and equivalent fractions.	
		Identify, name, read and write a numeral associated with the model of a fraction with a denominator less than 12.
		Construct and identify models for fractions with denominators 2-12.
		Determine whether two fractions are equivalent by using sets or pictures.
		Identify fractions that are equivalent to one, using concrete objects or models.
		Write the symbols =, < , > , to express the relationship between two fractions having the same denominators.
	4.4 Apply fraction operations to appropriate problems.	
		Add and subtract fractions with like denominators.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Determine and name the sum of two fractions with the same denominators (less than 13).
6.0 MEASUREMENT AND ESIMATIONS	6.1 Demonstrate conservation of length, volume and mass.	
	6.2 Have opportunities to use basic units of measure.	
		Measure an object by counting the number of units needed to match the length of the object, using counters such as sticks, pebbles or shells.
		Compare the lengths of various objects in the room by estimation, and then by matching to measure which is longer, and which is shorter.
		Weigh a set of objects and identify the heaviest and lightest, using a scale.
		Measure distances and heights using nonstandard units of measure.
		Use a thermometer to answer questions such as the following: "How can you tell if it is warmer inside or outside the classroom? Where is the coldest, hottest spot?"
		Find the perimeter of a figure by measuring the length of its sides.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Determine the volume of a given rectangular space by counting the number of cubic units needed to fill the space.
		Measure the surface of a rectangle.
		Measure and compare capacity (volume).
		Identify freezing point and boiling point.
		Use terms, abbreviations and symbols for units of measurement.
		Determine if the temperature is warmer or cooler than the previous day.
		Measure energy use by reading a meter.
	6.3 Tell time.	
		Name the hands on a traditional clock.
		Tell time on the hour and half hour.
		Name the months of the year.
		Explain a Native calendar.
		Name the days of the week.
		Recognize the numerical day/date.
		Tell time in terms of days, weeks and months.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Interpret a calendar.
		Tell time on the quarter hour with traditional or digital clock.
		Make simple equivalences such as one week = seven days, one year = 52 weeks, one year = 12 months.
	6.4 Count money.	
		Identify and name pennies, nickels and dimes and tell the value of each coin in cents.
		Select coins needed to solve simple word problems related to money.
		Determine the total value in decimal notation of pictures of coins and bills of different denominations.
		Relate coins and money to the history of money and trade. (See also Social Studies Guide)
		Act out real life problems such as buying items in a store.
		Tell the value of a set of coins in cent notation.
		Tell if a set of coins (values to $1.00) is enough to purchase a given object.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Solve simple addition or subtraction money problems for amounts up to $1.00.
		Organize coins by equivalences: one dime = two nickels, one quarter = five nickels, and one dollar = four quarters.
	6.5 Judge when to use basic units of measure.	
		Use appropriate terms of measurement.
		Choose the proper measuring instrument.
		Measure a line segment to the nearest whole unit.
		Measure and compare the capacity of a container to the nearest whole unit.
		Choose a bathroom scale and balance scale to weigh different objects in the classroom.
		Choose whether to represent distances from two points in cm, meters or kilometers (examples: one side of paper to another, desk to doorway, village to Anchorage).
	6.6 Estimate a measurement.	
		Measure how far it is from a student's home to some source of food, use kilometers, miles or pacing scales.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Measure the length of an object to the nearest half unit (inch, foot, yard, centimeter, meter).
		Estimate length and weight using standard units, within reasonable margins of error.
		Use words such as around, about and almost in sentences.
		Estimate length within reasonable limits.
	6.7 Convert units within a system of measurement.	
		Rename a measure in other units within the same system.
		Solve a problem which requires converting kilometers to meters.
7.0 GEOMETRY	7.1 Explain relative position and size of basic geometric shapes.	
		Identify objects as in front of, behind, below, on or above other objects.
		Identify objects that are inside, outside, or on a boundary of other objects.
		Identify objects as larger, smaller or about the same size as other objects.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	7.2 Identify names of basic geometric shapes.	
		Distinguish among basic geometric figures.
		Name basic geometric figures: triangles, squares, rectangles.
		Classify models or figures with rounded and straight sides into two groups.
		Identify and name edges and corners.
		Identify geometric shapes in the environment, and in art.
		Name geometric shapes used in an origami project. (See Fine Arts Guide.)
	7.3 Match and draw basic geometric shapes.	
		Draw and name circles, triangles, line segments and number lines.
		Group a set of objects containing balls, boxes and cylindrical-shaped objects according to shapes and tell which attributes were used.
		Describe a line segment or curve as a set of points.
		Construct and identify a simple curve as one that does not cross itself.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Identify and name closed and open simple curves.
		Identify the inside and outside of simple closed figures.
		Draw a square, rectangle and triangle using a straightedge.
		Draw a number line and label whole number points, using a ruler.
		Draw a line segment of given length using a ruler.
	7.4 Identify space figures.	
		Identify and name cubes, spheres, cylinders and cones.
		Find examples of lines that appear to be parallel, such as railroad tracks, telephone lines, or lines on a paper.
	7.5 Use congruency.	
		Select figures which are congruent.
		Discover tesselations of congruent shapes through pattern blocks.
		Match angles to determine which are congruent.
		Draw models of line segments which are congruent to the original model.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	7.6 Use symmetry.	Choose figures which possess line symmetry. Use geoboards and paperfolding to create symmetrical shapes.
	7.7 Use similarity.	Identify squares and triangles that possess similarity.
	7.8 Combine geometric shapes to make other geometric shapes.	Use attribute blocks to build new geometric shapes. Identify several geometric shapes in natural objects.
8.0 PROBABILITY AND STATISTICS	8.1 Gather data.	Collect information on the number of different plants within a designated plot. Identify school and classroom populations and subgroups within population. Tally information in games and classroom activities.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	8.2 Interpret data represented in a graph.	
		Read a graph of trends in numbers of farms in Alaska across time.
		Determine whether geese populations are increasing or decreasing by looking at (U.S. Fish and Wildlife Service) graph of population change.
		Interpret a simple bar graph or pictograph.
	8.3 Construct simple graphs from data.	
		Arrange collected data in tables and illustrate the data with bar graphs.
		Use blocks and pictographs to record information.
		Organize and graph a variety of data related to personal experiences and preferences.
		Make a chart to keep a record of daily weather.
		Make a graph to keep a record of achievement in some area.
	8.4 Be aware of chance and probability.	
		Discuss situations which involve the likelihood of events happening such as snow in July in your area, or the date that break up will come.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Predict and record the outcomes of coin tossing.
	8.5 Make predictions.	
		Predict the outcome of experiments, perform the experiments and compare results with predictions.
		Predict the weather for tomorrow, record class prediction and compare with outcome.
	8.6 List simple permutations.	
		Count the number of possible arrangements within a set, using concrete objects; record the arrangements.
9.0 MATH SENTENCES	9.1 Examine the concept of unknown.	
		Ask how many objects are under a sheet of cardboard.
	9.2 Compose math sentences.	
		Make up a story problem and answer it as a class.
	9.3 Identify types of and solve math sentences.	
		Use manipulatives to generate and solve open sentences with the teacher acting as recorder.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Solve open sentences using the addition facts for whole numbers with sums less than or equal to 999.
		Use < , >, = , ≠ , to make true number sentences.
		Classify types of sentences as open, true or false; correct or answer the false and open sentences.
10.0 PROBLEM SOLVING	10.1 Solve pattern problems.	
		Continue a pattern of attribute blocks.
		Create a pattern of colors for a partner to solve.
	10.2 Make logical conjectures about situations.	
		Use words such as and, or, if, then, to draw reasonable conclusions.
	10.3 Interpret diagrams as an aid to problem solving.	
		Discuss the dilemma posed by populations of organisms which tend to grow exponentially while food production grows arithmetically.
		Interpret and find solutions for word and picture problems.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	10.4 Estimate the solutions to problems.	Use estimation or "guess and check" techniques to solve measurement problems. Estimate answers in problem solving and computation problems. Estimate or guess a solution to a problem and test that solution.
	10.5 Restate a problem.	Restate a problem in his or her own words. Make up a word problem using everyday situations.
	10.6 Formulate math statements to describe problem situations.	Solve a number sentence for a one-step story problem. Find an answer to a problem by simplifying an expression or formulating a math statement. Choose the appropriate operation (addition or subtraction) to solve a number sentence.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
11.0 CALCULATORS AND COMPUTERS	11.1 Use a computer as a learning tool.	Play computer mathematics games. Use a computer to solve math problems. Incorporate computers as a tool to solve problems.
	11.2 Use simple calculating devices.	Use a hand calculator to add or subtract.

ELEMENTARY MATHEMATICS

GRADES 4 - 6

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
1.0 SETS	1.5 Demonstrate set concepts and basic principles of sets.	
		Join two or more sets and get a third set.
		Remove a subset from a given set of elements and get a remaining subset; write the number sentence that describes this process.
	1.6 Transfer an understanding of set concepts and basic principles of sets to real world situations.	
		Identify a set that is the union and the set that is the intersection of two given sets.
		Define finite, infinite and empty sets.
		Construct a Venn diagram that illustrates the relationship between two or three given sets.
12.0 INTEGERS	12.1 Demonstrate concepts related to integers.	
		Represent a physical situation such as a gain or loss in temperature with a positive or negative integer.
		Graph positive and negative numbers on a number line.
		Demonstrate how to find the sum of two integers.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
2.0 WHOLE NUMBERS - COUNTING AND NUMERATION		
	2.9 Demonstrate concepts related to counting, reading, writing and recognizing numbers and their order.	
		Identify, name, read and write numerals for whole numbers, 0-100,000,000.
		Order a set of whole numbers from largest to smallest or from smallest to largest.
		Identify a number as cardinal or ordinal.
		Use < , >, = , ≠ , to express the relationship between numbers up to 1,000,000,000.
	2.10 State place value up to ten digits.	
		Identify and name the values of digits that are in the ones, hundreds, thousands, ten thousands and hundred thousands places given a list of six digit numerals.
		Identify and name place value for each digit in a base ten (decimal) numeral.
		Write the expanded numeral using multiples of 10 for numerals up to 1,000,000 in the form (2x1000)+(3x100)+(5x10)+(7x1).
	2.11 Estimate whole numbers.	
		Round a whole number to any place, up to 1,000,000.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	2.12 Translate nondecimal numeration systems into decimal system.	
		Describe the cardinal number of a set of elements (0-100) in a base other than 10.
		Write a decimal numeral in a different base.
		Use telling time as an example of use of a different base.
		Describe the difference between Roman and Arabic numerals, including place value.
	2.13 Use the concepts of factors and multiples.	
		List all factors of any whole number less than 100.
		Name the Greatest Common Factor (GCF) for any 2 numbers less than 25.
		Name the Least Common Multiple (LCM) for any 2 numbers less than 20.
	2.14 List and compute prime numbers and composites.	
		Classify a set of whole numbers as prime, composite or units.
		Define composite number.
		List all prime numbers less than 100.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	2.15 Write exponential notation.	Identify and rename a product in exponential form. Find the value of a number expressed in exponential form.
	2.16 Write scientific notation.	Rename a given numeral using scientific notation. Use scientific notation for problems involving large numbers such as determining the reproduction of mussel in three generations with no fatalities. (See Science Curriculum Guide.)
3.0 WHOLE NUMBERS - OPERATIONS	3.23 Apply standard algorithms to addition and subtraction problems.	Check subtraction problems by writing related forms of the problems in addition. Use mental arithmetic to compute sums and differences less than 100. Name sums and differences for problems with numerals up to 1,000,000.
	3.24 Multiply and divide using standard algorithms.	Write the two related division equations of a multiplication equation.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Use sets or a number line to find products or quotients.
		Show how to find products and quotients through repeated addition or subtraction.
		Write two multiplication and two division equations to describe a physical situation.
		Name, using immediate recall, products or quotients through 81; use a number line as proof.
		Name the products for problems up to three digits times two digits.
		Name the products for problems using four digit factors by three digit factors.
		Name the quotient and remainder for problems with five digit dividends and two digit divisor with and without remainders.
		Use the distributive property for multiplying two digits times one digit problems.
		Find the sum of an addition or multiplication problem with three or more addends or products using the associative and commutative properties.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Check division problems without remainder by multiplication; check division problems with remainder by multiplication and addition.
		Use the algorithm to name the quotient and remainder for any reasonable division problem with a single-digit divisor.
	3.25 Apply the commutative and associative property of addition and multiplication using one-digit numerals.	
		Find the sum of an addition problem with three or four addends by renaming and rearranging using the commutative and associative property.
		Solve equations using the commutative property of multiplication and one-digit numerals.
		Find the sum and product of a problem with three or more addends or factors in the easiest way by using the commutative and associative property.
		Solve equations using the associative property of multiplication and one-digt numerals.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	3.26 Apply the identity element for multiplication.	Solve equations using the identity element for multiplication and one-digit numerals.
	3.27 Apply the multiplicative property of 0.	Solve equations using the multiplicative property of 0.
	3.28 Apply the distributive property of multiplication over addition.	Demonstrate the distributive property using sets.
	3.29 Predict the result of operations using odd and even numbers.	Predict and then find sums and differences for problems using odd and even numbers.
	3.30 Select an appropriate method of calculation.	Given a problem, choose estimation, mental arithmetic, paper and pencil, or calculator.
4.0 FRACTIONS AND DECIMALS	4.5 Differentiate among fractional numbers, equivalent fractions, improper and mixed fractions.	Identify, name and write fractions that are pictured or modeled.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Identify, name, read and write the fraction and/or the mixed numeral for a given fraction.
		Name the numerator and denominator of a given list of fractions.
		Write a set of fractions which are equivalent.
		Rename a given fraction in simplest form.
		Rename an improper fraction as a mixed number and vice versa.
		Name two fractions with like denominators and write the symbols $>$, $<$, $=$, $\neq$ to express the relationship between them.
		Write a set of fractions that are equivalent to a given fraction.
	4.6 Explain fractional numerals, equivalent, improper and mixed fractions.	
		Explain the function of numerators and denominators.
		Name the missing numerator or denominator for a mathematical sentence.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	4.7 State place value of decimals.	Name the place value for each digit in a decimal fraction to the hundredths place.
	4.8 Read decimal fractions to hundredths.	Identify, name, read and write a decimal fraction for a given model. Identify, name, read and write given decimal fractions with common fractions having denominators of 10 or 100.
	4.9 Read decimal fractions to thousandths.	Identify, name, read and write decimal fractions having denominators of 10, 100, or 1000. Round decimal fractions to the nearest whole number, tenth or hundredth.
	4.10 Order decimals.	Order decimal fractions up to tenths place.
	4.11 Compare fractions for ordering.	Order up to five fractions from least to greatest or from greatest to least.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	4.12 Classify decimal fractions.	Identify, name, read and write decimal fractions having denominators of 10, 100, 1000. Write a fraction in decimal form or a decimal fraction as a fraction in simplest form. Distinguish between repeating and terminating decimal fractions. Round decimals to any place. Estimate the sum, difference, product or quotient of the decimals.
5.0 FRACTION OPERATIONS		
	5.1 Know how to add and subtract fractions or decimals using standard algorithms.	Name the sums or differences of two fractions or decimal fractions. Add and subtract decimal fractions to the hundredths place, stressing expressions of money. Find the sum or difference of fractions using a model.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Check subtraction of fraction problems through addition.
		Estimate the sum or difference of two fractions to the nearest whole number.
		Use the commutative and associative properties to add and subtract fractions.
		Solve equations using the identity element.
	5.2 Apply standard algorithms to multiplication of fractions.	
		Multiply fractions and find the products using a multiplication model.
		Solve equations giving the products in lowest terms and written as whole numbers and fractions.
		Check division problems through multiplication.
		Use the commutative and associative properties to simplify computations.
	5.3 Multiply and divide fractions and decimals.	
		Multiply two decimals to the hundredths place.
		Divide a decimal by a whole number or by a decimal to the hundredths place.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	5.4 Apply multiplication inverses.	Name the reciprocals of a set of rational numbers and demonstrate that the product of any rational number and its reciprocal is one.
6.0 MEASUREMENT AND ESTIMATION	6.8 Apply the following units of measurement: length, area, capacity, time, money, weight, temperature.	Tell and write digital time to the nearest minute, showing a.m. and p.m. Count money and make change up to $25.00. Use various measuring devices to measure length in whole and fractional parts of units. Find the perimeter of a polygon by adding the measures of the sides. Measure and record the area of a rectangle or triangle. Measure the volume of a container without using a formula. Read and record the weight of an object to the nearest pound or kilogram, using simple scales.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Give the temperature in Fahrenheit and Celsius to the nearest degree using thermometers. (See also Science Curriculum Guide.)
		Measure time in seconds, minutes, hours, days, weeks, months, years, decades, and centuries.
		Use appropriate terms, abbreviations and symbols for the units of measurement in both English and metric systems.
	6.9 Estimate measurements.	Estimate length, weight and capacity using standard units of measure.
	6.10 Choose a measurement unit and use it correctly.	Select a suitable unit and/or measuring device and measure physical property.
		Determine local time for cities in the U.S.; explain the concept of time zones.
		Give the freezing and boiling points of water in Celsius and Fahrenheit.
		Choose the appropriate terms, abbreviations and symbols for units of measurement for use in a problem and in reporting data.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Estimate length, weight, capacity, time, temperature and money.
		Select the appropriate unit of mass to report weight of plankton, fish, seals, whales, and ships.
	6.11 Convert units of measure in the same system.	
		Rename a measure in other units.
		Compute a measurement problem, and rename the result if necessary.
7.0 GEOMETRY	7.9 Identify and measure simple plane geometric figures.	
		Distinguish among isosceles, equilateral and right triangles.
		Identify the diagonal of a square or rectangle.
		Define line and plane.
		Identify simple closed curves and interior and exterior regions of plane figures.
		Fill the interior space of a simple solid figure with unit cubes to determine volume.
		Find the perimeter of a polygon by adding the measures of the sides.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Read and write standard notation for plane figures.
		Define and measure an angle using a protractor.
		Measure the circumference and diameter of a cut out circle.
		Explain the rotation between circumference and diameter.
		Classify a set of quadrilaterals as parallelograms, rectangles, rhombi, squares or trapezoids.
		Identify right, acute and obtuse angles.
	7.10 Construct basic geometric figures.	Draw and label lines, line segments, rays, angles, polygons and quadrilaterals using a straightedge and compass or a protractor.
		Construct a right angle and right triangle using a straightedge and folded paper.
		Construct a circle, given the radius.
		Draw intersecting and perpendicular lines.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	7.11 Draw a graph on a number line or coordinate plane.	
		Explain and demonstrate that points in a plane (the first quadrant) can be represented by ordered pairs of numbers (coordinates).
		Plot ordered pairs on a coordinate plane.
		Graph a set of numbers on a number line.
	7.12 Identify simple space figures.	
		Distinguish among models of common polyhedra.
	7.13 Apply symmetry to geometric figures.	
		Construct a symmetrical figure.
	7.14 Apply the principle of congruency.	
		Identify pairs of line segments, angles, triangles or other polygons as congruent or not congruent.
		Explain the difference between equal and congruent figures.
	7.15 Construct plane figures.	
		Construct and label models of lines, line segments, rays, angles, and polygons using a straightedge.
		Construct a circle with a given center and radius or diameter, using a compass.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	7.16 Construct and bisect plane figures.	Match direction words with compass headings. Sketch examples of parallel, intersecting and perpendicular lines, using a straightedge. Construct a plane figure congruent to a given line segment, angle or triangle, using a straightedge and compass. Construct a circle, semi- or quarter circle with a given center and radius or diameter, using a compass.
8.0 PROBABILITY AND STATISTICS	8.7 Gather and organize data.	Collect, organize, analyze and illustrate data compiled from opinion polls, experiments, reference books, etc. Develop an extended record keeping project that includes collecting, organizing and graphing data. Compare bar, line and picture graphs which represent the same information; explain the advantages and disadvantages of each form. Analyze collected data according to range and mean.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	8.8 Interpret simple permutation problems.	
		Solve problems that involve a systematic identification of ordered arrangements using models, pictures, lists or diagrams.
	8.9 Translate information into picture, bar and line graphs.	
		Graph change in wildlife population number over time.
		Construct picture, bar and line graphs given suitable data.
		Construct a double bar graph.
		Record statistical data on tables or graphs, indicating change.
		Use information from charts and tables to solve problems.
	8.10 Construct a pie graph.	
		Compile statistical data for a pie graph.
		Construct a pie or circle graph.
		Use data to construct a pictograph when pictures represent more than one occurrence.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	8.11 Understand probability.	Make predictions based on simple data and verify the predictions with further experiments or additional research. Conduct probability experiments, using an increasing number of trials to obtain more reliable results. Identify events that are impossible and relate them to a probability of zero. Identify events that are certain and relate them to a probability of one. Conduct an experiment using random and unbiased samples. Report on the use of probability and statistics in careers. Discuss the importance of unbiased sampling while studying real-life issues. Demonstrate the multiplication principle of probability through experiments with tree diagrams or rosters.
	8.12 Understand the use of probability and statistics in other disciplines, in careers and in the real world.	

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Interview people in a variety of jobs and learn how they use probability and statistics.
		Examine government reports for the use of statistics.
		Determine the probability of scoring in sports events.
9.0 MATH SENTENCES	9.4 Compose a math sentence for a word problem.	
		Translate an English sentence into a mathematical sentence and solve.
	9.5 Apply math sentences of greater complexity.	
		Use > , < , = , ≠ to make true number sentences involving whole numbers, fractions, decimals, ratios and percents.
		Classify types of sentences as true or false.
		Determine the solution set for open sentences with a replacement set of whole numbers.
	9.6 Find replacements for variables that make number sentences true.	
		Use examples from students' daily lives to create math sentences with unknown variables.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
10.0 PROBLEM SOLVING	10.7 Use patterns and sequences in problem solving.	
		Continue a pattern of numbers involving multiplication or division and with five or fewer factors.
		Solve problems involving the four basic mathematical operations, using data from charts, tables, graphs and maps.
	10.8 Integrate relevant and nonrelevant information from other subject areas in problem solving.	
		Create word problems from a social studies or science text that can be solved with a mathematical operation.
		Tell when information is insufficient to solve a problem.
	10.9 Apply estimation in problem solving.	
		Explain how to use estimation as a tool for solving a problem.
	10.10 Restate a problem.	
		Restate a problem in his or her own words and select the data and operations necessary for solving the problem.
		Express a solution in a form compatible with a problem context.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	10.11 Breakdown a problem into its component parts.	
		Use data from charts, tables, graphs, tree diagrams and maps to solve problems.
		Tell when information is insufficient to solve a problem and irrelevant to the problem.
		Use rounding to estimate results for word problems.
	10.12 Interpret information for a solution.	
		Collect graphs from magazines and newspapers and explain them to the class.
		Choose items from a catalog and calculate their cost including postage, handling and other expenses.
		Recognize patterns such as increases, decreases or trends.
		Calculate the balance in a checking account using bank statements, bank deposit slips and bank checks.
		Find mean, median, mode and range.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	10.13 Interpret story problems.	Use estimation to determine if solutions to word problems are reasonable. Use brainstorming to generate solutions to a problem. Interpret variations in a model in terms of the original problem situation.
11.0 CALCULATORS AND COMPUTERS	11.3 Use software and hardware to solve problems.	Enter data into a computer program to test mathematical theories.
	11.4 Operate a hand calculator.	Demonstrate how to add, subtract, multiply and divide on a hand calculator. Use a calculator to find sums, differences, products or quotients of integers or decimals. Find the percent of a number using a calculator. Find the square root of a number using a calculator.

MATHEMATICS

GRADES 7 - 8

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TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
12.0 INTEGERS	12.2 Apply the concept of integers.	Add, subtract, multiply and divide integers, both positive and negative.
2.0 WHOLE NUMBERS - COUNTING AND NUMERATION	2.17 Demonstrate concepts related to counting, reading, writing and recognizing whole numbers.	Identify, name, read and write different names for the same number, using different numeration systems and formats.
	2.18 Demonstrate expanded notation.	Write an expanded numeral using exponential notation.
	2.19 Apply divisibility rules.	Use divisibility rules for 2, 3, 5, 9 and 10 as an aid in factoring.
	2.20 Calculate factors and multiples.	Find all the factors of a given whole number less than 1000. List multiples of a given whole number less than 1000. Determine the Greatest Common Factor (GCF) of a set of three numbers having less than four digits.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Determine the Least Common Multiple (LCM) of a set of three numbers having less than four digits.
	2.21 Apply prime numbers, composites and factorization.	
		Determine the complete prime factorization for any whole number having less than four digits.
	2.22 Use scientific notation.	
		Write any number, having less than seven digits, in scientific notation.
	2.23 Determine squares and define exponents.	
		Find the square of any whole number less than 100.
3.0 WHOLE NUMBERS - OPERATIONS	3.31 Add, subtract, multiply and divide whole numbers.	
		Solve problems involving whole numbers, both positive and negative, to demonstrate proficiency in the basic operations.
	3.32 Use the associative, commutative and distributive law to simplify calculations.	

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	3.33 Estimate answers to computational problems, and explain the most appropriate method of operation.	Explain why estimation, mental arithmetic, paper and pencil, or calculator is the best choice for problems of different natures.
4.0 FRACTIONS AND DECIMALS	4.13 Explain and use decimal notation.	Read a numeral such as 2,479.6305 and write it in words. Apply decimals to our money system.
	4.14 Determine terminating decimals and fraction equivalents.	Determine the equivalents for common fractions given a set of decimal fractions. Write a set of fractions and decimal fractions that are equivalent to 7/8.
	4.15 Add, subtract, multiply and divide fractions and decimals.	Find the sum, difference, product and quotient of fractions, mixed numerals and decimal fractions. Use the properties of addition and multiplication of decimal fractions.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	4.16 Estimate and round decimal answers.	Check the reasonableness and place value of decimal answers from calculator computations.
	4.17 Determine and order equivalent fractions, decimals and percents.	Write a set of fractions which are equivalent to 15/16 in common and decimal forms.
		Order a set of ten common fractions and a set of ten decimal fractions from least to greatest with and without the same number of decimal places.
		Determine the equivalent common fractions of a set of terminating decimals.
		Determine the equivalent decimal fractions of a set of common fractions.
13.0 RATIO, PERCENT, AND PROPORTION	13.1 Explain and determine ratio, percent and proportion.	Demonstrate that a proportion is a statement of two equivalent ratios.
		Use circle graphs to interpret percent.
	13.2 Solve the three basic types of percent problems.	Apply an understanding of percent operations to determine prices of sale items at particular percent discounts.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Compute the percent of a number using equivalent fractions or decimals.
		Apply percent concepts to sales tax.
		Find the percent of a number using equivalent fractions or decimals.
		Find the percentage given the base and rate.
		Rename percents as equivalent forms.
		Solve problems involving discount, simple interest, commission and sales tax.
	13.3 Evaluate using ratio and proportion.	Write the ratio that describes the comparison of any two quantities in both forms and express it in words.
		Determine the value of the missing component of a proportion.
6.0 MEASUREMENT AND ESTIMATION	6.12 Demonstrate the process of measuring.	
		Use various measuring devices to measure and record length in whole and fractional parts using customary or metric units.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	6.13 Choose the appropriate formulas to find perimeter, circumference and area of polygons and circles, and surface areas of solids.	
		Compute the surface area of rectangular prisms, cubes, spheres, pyramids and cylinders using appropriate formulas.
		Find the volume of cylinders, cubes and rectangular solids.
	6.14 Apply measuring systems.	
		Read or estimate distances on maps and globes.
		Measure time and temperature.
		Solve problems involving money.
		Measure the angles of polygons using a protractor.
		Estimate length, weight, time, temperature and money using appropriate units and terms.
		Solve problems relating to speed.
	6.15 Examine the approximate nature of measurement and possibility of error.	
		Use the concept of rounding.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	6.16 Apply process of measuring to non-standard situations.	Determine the force and value of stream flow. Measure the approximate area of an irregular figure drawn on graph paper.
	6.17 Evaluate reasonableness using estimation.	Define error or measurement.
7.0 GEOMETRY	7.17 Determine and differentiate complementary and supplementary angles.	Measure an angle and find its complement or supplement.
	7.18 Use the Pythagoream Theorem.	Determine the length of missing sides in a right triangle.
	7.19 Measure angles in geometric figures.	Find the sum of the angles in a polygon.
	7.20 Create examples to represent geometric terms.	Find examples to perpendicular and intersecting lines and planes in nature. Identify acute, right, obtuse and complementary angles.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
		Use Logo to develop geometric understanding.
	7.21 Construct geometric figures.	Use compass and straightedge to create different polygons.
	7.22 Apply basic mathematical operations to geometry.	Solve problems related to computation and measurement of geometric figures to demonstrate proficiency.
	7.23 Identify and classify relationships between parts of a single figure or between two figures.	Find squares and triangles in an apartment building or village store.
	7.24 Demonstrate relationships involving geometric concepts.	Prove that the sum of angle of a triangle equals 180°.
		Determine an approximate value of Pi experimentally.
8.0 PROBABILITY AND STATISTICS	8.13 Determine the mean, median, mode and range of a set of data.	Find the arithmetic mean (average) for a given set of numerical data.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	8.14 Recognize and discuss the use and misuse of statistics.	Gather examples of use of statistics from newspaper and magazines and examine for bias. Use the same statistics to support two opposing arguments.
	8.15 Define percentile and differentiate percent and percentile.	Analyze standardized tests both percentile scores and percent of students achieving that score.
	8.16 Analyze statistics for accuracy.	Criticize a standardized test by analyzing the norm. Explain the derivation of an index number, such as Consumer Product Index.
	8.17 Determine the probability of an event from observed outcomes.	Use a players batting average to determine the probability of hitting a pitch.
	8.18 Identify the probability of an event as a fraction.	Write the probability of a student who is absent from math class as a fraction.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	8.19 Create a frequency distribution for a given list of data.	Make a frequency distribution for the color of shirts and blouses of students in the math class.
	8.20 Demonstrate the concept of correlation.	Identify a correlation as positive, negative or 0 for a given scatterplot. Distinguish between correlation and causation.
	8.21 Evaluate the quality of data.	Analyze the quality of data based on the source of information and gathering techniques.
9.0 MATH SENTENCES	9.7 Write and solve math sentences.	Solve simple linear equations using non-negative, rational numbers in the replacement set. Apply the operational symbols, +, −, x and ÷ to form true sentences using non-negative rational numbers and integers. Solve simple inequalities. Use brackets and parentheses to show the order of operation in mathematical expressions involving addition, subtraction, multiplication and division.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	9.8 Write a math sentence to represent a table of input and output numbers.	
		Write and solve linear equations to demonstrate proficiency in applying operational symbols, constructing mathematical sentences, determining solution sets, using proportion, translating English sentences into mathematical sentences, using parentheses and brackets, determining averages and simple probability.
	9.9 Solve open sentences involving up to two variables.	
		Use tables and graphs to assemble guess and test procedures.
10.0 PROBLEM SOLVING	10.14 Solve problems.	
		Determine the rule for completing a number pattern.
		Construct flow charts to show steps in operations and solutions of word problems.
		Formulate math statements to describe problem situations.
		Select processes and formulas to solve word problems.

TOPIC/CONCEPT	LEARNING OBJECTIVE/OUTCOME	SAMPLE LEARNING ACTIVITY
	The Learner will:	
	10.15 Use a hand calculator to solve problems.	Use a hand calculator to solve simple equations.
	10.16 Judge when it is appropriate to use paper/pencil computation, estimation or a calculator	Solve problems of varying nature using appropriate means.
	10.17 Write simple computer programs to solve problems.	Program the computer to draw graphics. Program the computer to perform math operations.
11.0 CALCULATORS AND COMPUTERS	11.5 Use computer hardware and software to solve problems.	Use spread sheet software to perform repetitive calculations.

HISTOGRAMS

ACKNOWLEDGEMENTS (Editions I/II)

MODEL
CURRICULUM
GUIDE
PROJECT

Subject: Mathematics
Course: All
Level: Primary
Grade(s): K-3
Date: 6/26/86

PERCENTAGE OF
EDUCATIONAL OUTCOMES

Objective	N	%	Histogram of Percentages (10 20 30 40 50 60 70 80 90 100)
COGNITIVE			
1.10 Knowledge of specifics	11	16	********
1.20 Knowledge of ways and means of dealing with specifics	7	10	*****
1.30 Knowledge of universals and abstractions	2	3	**
2.00 Comprehension	6	9	*****
3.00 Application	41	59	**********
4.00 Analysis	2	3	**
5.00 Synthesis	1	1	*
6.00 Evaluation	0	0	
SUBTOTAL	70	100	
AFFECTIVE	0	0	
PSYCHOMOTOR	0	0	
Not Classifiable	0	0	
TOTAL	70	100	

ALASKA MODEL CURRICULUM GUIDES

HISTOGRAM

This histogram of the cognitive levels of the learning objectives/outcomes is provided for the Alaska Model Curriculum Guides. The histogram is a bar graph that shows the percentages of objectives at each different cognitive level, adapted from Bloom's Taxonomy of Cognitive Levels. It provides a way to look at and understand the different "levels" of thinking required to accomplish a particular objective.

Thinking skills must be taught and reviewed to ensure something beyond the mere recall of facts. Every objective in the guides was analyzed and assigned a number indicating its cognitive level and tallied. The histogram indicates where the emphasis is within the cognitive level.

There is no ideal distribution we can use for a model, but it provides a source for professional judgement about the learning objectives/outcomes. The histogram does not necessarily show what ought to be, but rather reflects what is in this particular set of concepts promoted in the curriculum guides for school districts in Alaska.

MODEL
CURRICULUM
GUIDE
PROJECT

Subject: Mathematics
Course: All
Level: Elementary
Grade(s): 4-6
Date: 6/26/86

PERCENTAGE OF
EDUCATIONAL OUTCOMES

Objective	N	%	Histogram of Percentages (10 20 30 40 50 60 70 80 90 100)
COGNITIVE			
1.10 Knowledge of specifics	1	2	*
1.20 Knowledge of ways and means of dealing with specifics	0	0	
1.30 Knowledge of universals and abstractions	0	0	
2.00 Comprehension	27	44	**********
3.00 Application	33	54	**********
4.00 Analysis	0	0	
5.00 Synthesis	0	0	
6.00 Evaluation	0	0	
SUBTOTAL	61	100	
AFFECTIVE	0	0	
PSYCHOMOTOR	0	0	
Not Classifiable	0	0	
TOTAL	61	100	

ALASKA MODEL CURRICULUM GUIDES

HISTOGRAM

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Thinking skills must be taught and reviewed to ensure something beyond the mere recall of facts. Every objective in the guides was analyzed and assigned a number indicating its cognitive level and tallied. The histogram indicates where the emphasis is within the cognitive level.

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MODEL
CURRICULUM
GUIDE
PROJECT

Subject: Mathematics
Course: All
Level: Jr. High
Grade(s): 7-8
Date: 6/26/86

PERCENTAGE OF EDUCATIONAL OUTCOMES

Objective	N	%	Histogram of Percentages (10 20 30 40 50 60 70 80 90 100)
COGNITIVE			
1.10 Knowledge of specifics	1	2	*
1.20 Knowledge of ways and means of dealing with specifics	0	0	
1.30 Knowledge of universals and abstractions	0	0	
2.00 Comprehension	11	21	**********
3.00 Application	37	71	**********
4.00 Analysis	1	2	*
5.00 Synthesis	0	0	
6.00 Evaluation	2	4	**
SUBTOTAL	52	100	
AFFECTIVE	0	0	
PSYCHOMOTOR	0	0	
Not Classifiable	0	0	
TOTAL	52	100	

x

ALASKA MODEL CURRICULUM GUIDES

HISTOGRAM

This histogram of the cognitive levels of the learning objectives/outcomes is provided for the Alaska Model Curriculum Guides. The histogram is a bar graph that shows the percentages of objectives at each different cognitive level, adapted from Bloom's Taxonomy of Cognitive Levels. It provides a way to look at and understand the different "levels" of thinking required to accomplish a particular objective.

Thinking skills must be taught and reviewed to ensure something beyond the mere recall of facts. Every objective in the guides was analyzed and assigned a number indicating its cognitive level and tallied. The histogram indicates where the emphasis is within the cognitive level.

There is no ideal distribution we can use for a model, but it provides a source for professional judgement about the learning objectives/ outcomes. The histogram does not necessarily show what ought to be, but rather reflects what is in this particular set of concepts promoted in the curriculum guides for school districts in Alaska.

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FIRST EDITION

1985

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Haines
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Kenai Peninsula
Ketchikan
Klawock
Lower Kuskokwim
Lower Yukon
Matanuska-Susitna
Nenana
Nome
North Slope
Northwest Arctic
Pelican
Railbelt
Valdez
Yakutat

State Departments of Education

Alabama
Arizona
Arkansas
California
Connecticut
Delaware
Florida
Idaho
Illinois
Indiana
Maine
Minnesota
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Nevada
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New York
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1986

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